

# USGS UAS Program Does More with Less

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**T**he Department of the Interior (DOI) manages more than 500 million acres of surface land, or about one-fifth of U.S. land. Within DOI, the U.S. Geological Survey (USGS) provides impartial information on ecosystems, natural hazards, water resources, energy, climate, land use change and core data services such as mapping.

USGS has a rich history related to remote sensing, including operating the Landsat series of satellites for several decades. Today, the USGS National Unmanned Aircraft Systems (UAS) Project Office is leading the implementation of UAS technology to monitor environmental conditions, analyze the impacts of climate change, respond to natural hazards, understand landscape change rates and consequences, conduct wildlife inventories and support related land management missions.

## UAS Implementation

The agency's use of UAS technology dates back to 2004 when a UAS was used to acquire data during a volcanic event on Mount St. Helens. After carefully monitoring the rapid advancements of UAS technology, USGS determined the technology was ready to be employed for scientific, environmental and land management applications. The USGS National UAS Project Office was created in May 2008 to evaluate and transfer UAS technology into DOI's decision-making toolbox.

But USGS isn't acting alone; there's an energized, active, collaborative team working across many federal agencies, academia and private industry to maximize UAS use. A recent report published by the Association for Unmanned Vehicle Systems International indicated that more than 70,000 U.S. jobs will be created in the first three years of UAS integration into the National Airspace System (NAS), with an economic impact of more than \$13.6 billion.

Similar to the use of the Internet, geographic information system technology and the Global Positioning System, UASs are enabling USGS scientists to be better stewards of the land. UAS technology provides scientists a way to look longer, closer and more frequently at some of Earth's most remote areas—places that were previously too dangerous or expensive to monitor in detail. The flexibility of

operations and relative low cost of small UASs enhances the ability to track long-term landscape and environmental change. In addition, users quickly can assess landscape-altering events such as wildfires, floods and volcanoes.

## Diverse Applications

DOI requirements for UAS missions are "bubbling up" from field-level staff. The innovation and dedication of DOI scientists and resource managers are apparent as they turn to UAS and associated remote sensing tools to perform traditional tasks more cheaply and create new uses for the technology. Wildlife biologists were the first to implement the technology (monitoring and inventorying wildlife), followed by geologists (detecting landslides, mapping fault zones), hydrologists (monitoring shoreline erosion and stream temperature gradients) and ecologists (habitat mapping).

DOI's public safety professionals are interested in using UAS to support their missions, including search and rescue, monitoring

T-Hawk to test and evaluate small UAS technology. The agency's most exciting UAS-related development is the miniaturization and variety of readily available sensor packages.

Using a UAS, USGS can tailor sensor solutions to meet project requirements. The agency can readily obtain high-resolution video, acquire thermal imagery, detect chemical plumes, collect point cloud data, generate high-resolution digital elevation models and locate animals that have been tagged with tracking devices at a fraction of the cost of conventional surveying methods.

DOI is keenly aware of and concerned with expenses related to system acquisition, maintenance, operator training and data processing. As a result, USGS strives to define cross-cutting requirements to minimize the number of systems in place yet maximize their use.

In addition, USGS recognizes that larger UAS systems will play a role in meeting mission requirements. The agency anticipates contracting for data services with commercial

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pipelines and wildland firefighting. In general, if an observation can be performed with a manned aircraft today, DOI anticipates doing it with a UAS in the future. The goal is to recognize a 10:1 cost savings by using small UASs rather than traditional manned aircraft when appropriate.

Smaller systems (less than 55 pounds) probably will be the first UASs approved by the Federal Aviation Administration for routine use in the NAS. USGS currently uses the AeroVironment Raven and Honeywell

UAS vendors to meet long-duration or specialized acquisition requirements, i.e., state or national aerial photography or light detection and ranging surveys.

UAS technology will allow USGS to do more with less and in the process enhance the agency's ability to provide unbiased scientific information to help stakeholders make informed decisions. USGS expects that by 2020, UAS will emerge as the primary platform for DOI aerial remote sensing applications. **EJ**



Riverbank erosion is one of many UAS applications USGS is exploring.



USGS National UAS Project Office